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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 10/531,423 | 04/15/2005 | Ryou Obara | OBARA7 | 9086 |

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EXAMINER

SAVAGE, JASON L

ART UNIT PAPER NUMBER

1775

DATE MAILED: 07/28/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

8

Office Action Summary

Application No.

10/531,423

Applicant(s)

OBARA ET AL.

Examiner

Jason L. Savage

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 01 May 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 18-32 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 18, 19 and 24-28 is/are allowed.
- 6) ☒ Claim(s) 20-22 and 29-32 is/are rejected.
- 7) ☒ Claim(s) 23 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- 4) ☒ Interview Summary (PTO-413)
Paper No(s)/Mail Date. 20060721.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

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The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 20-22 and 29-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Herbst-Dederichs (Certified English Translation of DE 100 61 750 A1).

Herbst-Dederichs teaches high-speed flame spraying of a chromium carbide containing powder mixture to form an abrasion and wear resistant protective coating on an outer surface of a piston ring (par[0001-0002] and Figure 1). Herbst-Dederichs further teaches that the coating comprises chromium carbide particles having a particle size of less than 3 μm dispersed in a metal matrix Ni-Cr alloy (par[0006]). Herbst-Dederichs further teaches that the coating contains second phases of materials such as molybdenum or cobalt (par [0008 and 0011] and Figure 1). Although Herbst-Dederichs does not explicitly recite the relative amounts of the first phase matrix metal and the second phase metal, given the description that molybdenum exists as embedded phases and cobalt as a binding phase for the tungsten carbides, it is the position of the Examiner that the first phase of Ni-Cr exists more than the second phases. Herbst-Dederichs further teaches that by limiting the particles to this size the carbide outbreak is lowered, the risk of cracking is minimized and internal stresses in the carbide are reduced (par[0007]).

Regarding the limitation that the piston ring is combined with a cylinder liner of cast iron having a tensile strength of 300 Mpa or less, Herbst-Dederichs is silent to the piston being combined with the claimed cylinder liner. However, the use of cylinder liners, and in particular cast iron cylinder liners is known in the art. It would have been obvious to one of ordinary skill in the art to combine the coated piston of Herbst-Dederichs with a cylinder liner of any material including a cast iron with the claimed tensile strength with a reasonable expectation of success since the coating of Herbst-Dederichs is taught to provide improved abrasion and wear resistance as well as a reduction in carbide outbreak, a risk in cracking and internal stress.

Regarding claim 21, Herbst-Dederichs is silent as to the area ratio of the first phase to a surface portion excluding pores; however for the reasons set forth above, it is the position of the Examiner that the first phase comprise the majority of the coating. It would have been obvious to one of ordinary skill in the art at the time of the invention to have provided the coating of Herbst-Dederichs with the Ni-Cr first matrix phase in an amount over 60% with a reasonable expectation of success.

Regarding claim 22, as was set forth above, Herbst-Dederichs teaches the carbide particle size is within the claimed range.

Regarding claim 29, as was set forth above, Herbst-Dederichs teaches that the use of second phase forming metals including molybdenum or cobalt are suitable for use. Herbst-Dederichs teaches that the cobalt containing second phase forming material may be provided in powder form [par 0006]. Furthermore, although Herbst-Dederichs is silent as to the method of providing a second phase material such as

molybdenum, it would have been obvious to one of ordinary skill in the art to have provided it as a separate powder since Herbst-Dederichs teaches the use of multiple powders in the thermal spraying process.

Regarding claims 30 and 32, the use of an HVOF spraying method such as is taught by Herbst-Dederichs (par[0002]) would meet the limitation of rapidly solidifying a melt of the matrix metal containing the chromium carbide particles as well as meeting the limitation of claim 32 that the spraying method is an HVOF process.

Regarding claim 31, Herbst-Dederichs teaches that the composite powders comprising chromium carbide and the matrix metals are formed into agglomerated powders which are sintered.

Response to Arguments

Applicant's arguments with respect to claims 20-23 and 29-32 have been considered but are moot in view of the new ground(s) of rejection.

Applicant's questioning of whether 2004/0069141 of Herbst-Dederichs qualifies as prior art. In response thereto, a certified translation based on the priority document DE 100 61 750 has been provided. The publication date of DE 100 61 750 is 6-20-2002.

In response to Applicant's arguments regarding the limitation of the tensile strength of the liner being less than 300 MPa, given that Harada merely recited a wear resistant coating and made no teaching or suggestion using the coating on a piston ring

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or in combination with a liner, the rejection has been withdrawn. However, new ground of rejection were set forth above.

Regarding the argument that Herbst-Dederichs does not recite the tensile strength of a liner being within the claimed range, the combination of cylinder liners with piston rings is conventional. Regarding the limitation that the liner be cast iron having the claimed tensile strength, the use of cast iron cylinder liners is also conventional such as is described in Ishikawa et al. US 6,553,957 (col. 1, ln. 18-30). It would have been obvious to one of ordinary skill in the art to combine the coated piston of Herbst-Dederichs with a cylinder liner of any material including a cast iron with the claimed tensile strength with a reasonable expectation of success.

Allowable Subject Matter

Claims 18-19 and 24-28 are allowed.

Claim 23 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter:

The prior art teaches a piston ring comprising a thermal spray coating on the outer peripheral surface which comprises a chromium carbide particles having an

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average particle size of 3 μm or less which are dispersed in a Ni-Cr alloy matrix which may further contain a second phase metal. The prior art further teaches that the combination of cast iron cylinder liners with coated piston rings are conventional.


However, the prior art does not teach or suggest that the coating have the claimed average pore diameter of 10 μm or less and a porosity of 8% or less by volume. As was set forth in the specification, on page 9, lines 10-22, it is necessary to have the claimed pore diameter and porosity in order to insure the pores do not function as sites from which the chromium carbide particles debond from the coating during sliding.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jason L. Savage whose telephone number is 571-272-1542. The examiner can normally be reached on M-F 6:30-4:00.

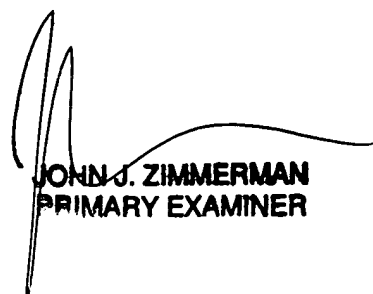
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jennifer McNeil can be reached on 571-272-1540. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.



Jason Savage
7-21-06



JOHN J. ZIMMERMAN
PRIMARY EXAMINER